THE MOTIVATIONAL EFFICACY OF SELF-REGULATED ICT RESOURCES ON INTEREST IN BIOLOGY AMONG HIGH, MEDIUM, AND LOW ACHIEVING SECONDARY SCHOOL STUDENTS

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ABSTRACT

This study examined the impact of technological software on learning from an interactive hypermedia. It explores participants' learning interest and engagement, analyzing variations based on their score levels. The mixed method study adopted a pretest, posttest, quasi-experimental design using 3x2x3 factorial matrix, a Semi-Structured interview guide, and a Students' interest inventory, entitled Questionnaire on the effect of ICT Resources on the Interest of Students in Biology (QEIISB) utilized to elicit responses on students' interest. Post-hoc analysis was used to determine the direction of difference and findings revealed were discussed in the context of perfect understanding across achievement levels, because participants showed better interest and engagement more in the group of medium Scorers. The medium score level students showed significant interest and benefitted most from the software. By evaluating the efficiency of Information and Communication Technological (ICT) tools, influence students with varying performance or achievement levels, the study aims to provide insights into the effective these resources influence achievement and foster better interest in teaching and learning.

Keywords: Information and Communication Technological (ICT), Interactive hypermedia, Student Achievement, Student Interest, Achievement level, Score level

INTRODUCTION

The mutual effect Information and Communication Technological (ICT) use, and academic success of students had been documented in a number of studies, (Müller & Seufert, 2018); (Chan, et al 2020); (Oniyide et al 2023). However, the influence of students' interest in ICT use has not been fully investigated from students' low, medium and high Achievement levels perspectives, and the persistence in failure rateis a pointer to this fact. Thus, this study examined the effect of ICT resources on low, medium and high scoring students' interest in biology, in a bid to improve students' success rate, and foster sustainable education.

The usefulness of ICT had greatly penetrated into every aspect in the society, bringing changes into the structure of working activities, knowledge acquisition, proficiency of intellectuals and scholars to communicate effectively through the use of technologies, such as emails, encyclopedia and classroom instruction (Olaore, 2014; Walan and Enochsson, 2022).

This talk-chalk method is mostly used as a swift means to accelerate syllabus coverage. However, this approach mostly impairs the interest of students in the learning of biology (Edem&Ekon, 2015).

Students' interest in biology cannot be separated from the academic achievement of students, since poor or good academic achievement depends greatly on the interest of students in biology (Awodun, Adekunle &Femi-Adeoye, 2019). The interests of students in a particular subject indicate the attention paid by students to the learning of the subject. Also, enjoyment of science, perhaps in an environment rich in ICT resources is central to students' development of interest as the learning outcome and practicing science. Students learn better when motivated intrinsically, by the learning activity. For some decades now, researchers intensify self-regulated learning as strategic and potent in making learning environment friendly and encouraging inclusive education, both for various kinds of learners and their learning situations. But it is of concern in this study if this all-important type of learning is valuable across varying score levels or achievement levels in students (Dignath&Büttner, 2008; Panadero, Jonsson, & Botella, 2017).

Score level as a moderating effect is gradually gaining attention as a line of research. Wu, Guo, Yang, Zao, and Guo, (2021), in a meta analyses, using 240 effect sizes from 68 longitudinal studies, in order to examine the relationship between academic self-concept and achievement, reported that academic score /achievement level amongst other variables, had significant influence on academic self-concept and students' achievement. Hong (2014) discovered a huge improvement in curiosity and anxiety of high score students in learning science. He worked with thirty-seven eight grade students 16 boys and 21 girls; this was done to explain high score students learning anxiety and attitude and invariably interest in science and conducted an experiment of a 20 week collaborative intervention as form of a novel pedagogical strategy. The experimental study was conducted quantitatively through the use of collaborative intervention which entails "an introduction of the history of science, lectures, seminars, hands-on activities such as inquiry based experiments, team competitions, peer tutoring, small group discussions, demonstrations of scientific myths, cooperative learning, evaluative exercise, and science projects leading to the ability to make evidence based conclusion" (Lawson & Gibbs, 1992). The strategy known as team competition was also employed which could enhance high achieving students' interest and help them to apply cognitive knowledge to everyday problem with the carrying out of research in group which gave them the opportunity to do science. In that sense, the students interact with the subject matter and in the process

of this interaction, create their own ideas. After conducting this experiment, the researchers investigated qualitatively by conducting follow-up interview and questionnaire during the collaborative intervention. It was revealed in the study that those students in the experimental group showed positive attitude and reduced anxiety in learning science.

The intricacies of ICT use and achievement levels in educational research is thriving in the last decades, it is in theinterest of this present research to address this line of research as it fosters self-regulated learning in according to achievement levels in science learners. Our research attempts find its root in Connectivism as a theory of learning which is pertinent to the digital era. The idea advocated by the proponents of the Connectivism theory refer to learning as not intrapersonal, and this opposes the views of Behaviorism, Cognitivism, and Contructvism theories. From an evolutionary perspective, Siemen (2004) advocated that the Connectivism theory is an extension of the existing theories of learning. This position according to Siemen was because Connectivsm takes cognizance of the vast connectivity of the educational environment in which teachers teach and students learn nowadays. Therefore, it was propounded that learning was not only limited to individuals but could also embedded in technologies. According to Siemen (2004), Mampota, Mokhet'sengoane, Kuurata, (2023) explained the ability of Connectivsm theory to explain the capacity of technologies to influence learning, since the half-life of knowledge which is the time frame between the discovery of information and the information becoming obsolete had reduced. Also, some basic processes involved in learning as explained by existing learning theories have changed.

The ICT resources investigated was the Hypermedia. Overall, prompts in hypermedia use were shown to boost achievement and self-efficacy. However, the question is arising in this research isto explore the effect of ICT resources on secondary school students Interest based on score levels?Therefore we hypothesize that there is no significant difference in interest of low, medium, and high scoring students taught biology with ICT Resources.

MATERIALS AND METHODS

This research examined the impact of ICT resources on senior secondary school students' achievement and interest in biology.The content scope was Cell division and Genetics, some of the seemingly challenging concepts in biology. this research involved a pretest, posttest, quasi-experimental design, using intact classes, of a 3 x 2 x 3 factorial matrix (Nworgu, 2006). The first 3 represents two experimental groups and one control group (3 levels of Treatment), the other two represents male and female (2 levels of gender) while the other three represents the three levels include low score level obtained from the previous end of session scores (Students that score a maximum of 39 marks and below), Medium score level (Students that have scores ranging between 40 and 59) and high score level (Students that score a minimum of 60 marks and above, respectively

Students' interest was elicited by an adapted questionnaire from the International Comparative ROSE Project (Relevance of Science Education).

The mode of classroom virtual reality experienced by the students involved offline and online use virtual biochemical processes embedded as videos, hyperlinks and hypertexts in the Microsoft Encarta encyclopedia software as a teaching package.

The target group was Senior Secondary School (SSS) II students offering biology. A total of three hundred and sixty-four (364) Senior Secondary II students participated fully by writing both pretest and posttest, and 10 teachers were purposively selected from three coeducational schools for the purpose of this study. The Biology Achievement Test, Biology interest inventory (questionnaire) and the Semi-structure interview guide were used in the study. The questionnaire was adapted from the Relevance of Science Education (ROSE) questionnaire for eliciting students' interest. However, other product variables or dependent variables was students' interest, while the independent variables and moderating variables were the ICT resources-Virtual Reality (VR), and score levels like connectivism, advocates a critical capacity to learn, that is more than creating knowledge from experiences.

Research Outline
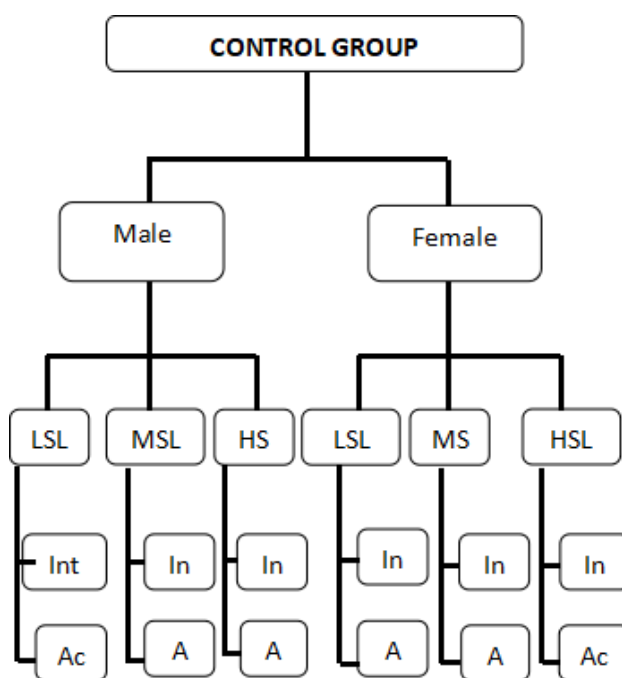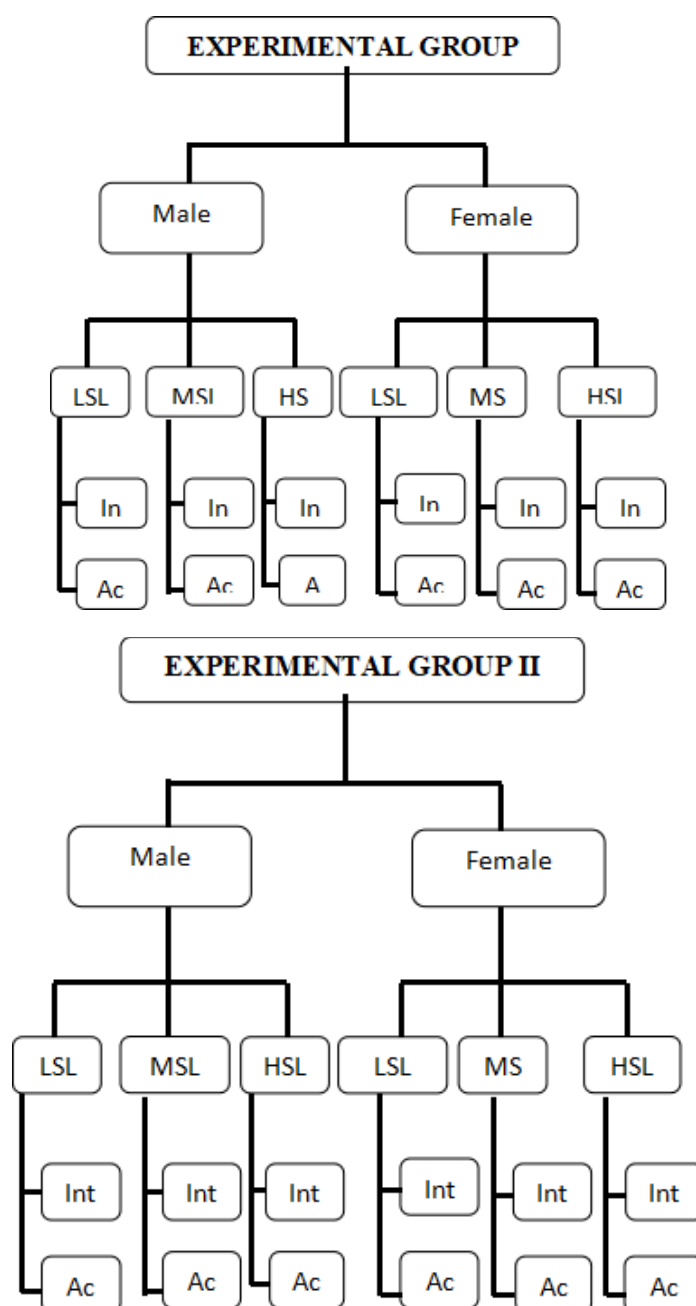
KEY:
LSL-Low score Level, MSL- Medium Score Level, HSL- High Score Level,
Int -Interest, Ac-Achievement

RESULTS AND DISCUSSION

Table 1 reveals that at pretest, the mean scores for Low, Medium and High Scoring students were at clear cut boundaries. However, after the treatment and subsequently at posttest, the effect of ICT Resources to improve achievement is best on the group of students that were Medium Scorers with a Mean gain score of 7.79 (4.68%) which was the highest

Table 1: The Description of Students' Mean Interest Gain Scores when taught with ICT Resources based on Score Levels

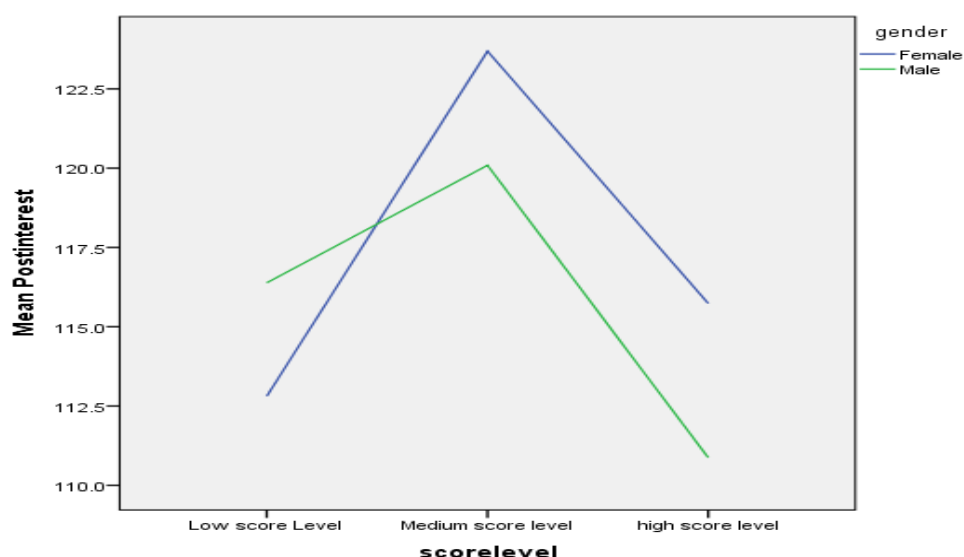| Score levels	No	Pre-interest		Post interest		Gain score
		$\bar{x}$	SD	$\bar{x}$	SD	
Low Score Level	34	110.94	10.00	114.18	9.18	3.24
Medium Score Level	161	113.96	17.10	121.75	14.65	7.79
High Score Level	169	116.17	14.50	113.26	21.96	-2.91

Figure 1: Figure showing the mean posttest of the groups by score level and gender

Research Hypothesis

There is no statistically significant difference in the interest of Low, Medium and High scoring students taught biology with ICT Resources.

Results of the ANCOVA analysis for data for the effect of ICT resources students' interest based on score level as shown in the Table 2 revealed that the value associated with the calculated value for F (10.47) for the effect of the Treatment (ICT resources) on the interest of students in biology is (0.00) which is less than the 0.05 level of significance. $F_{(2, 347)} = 10.47$, $p<0.05$.

Therefore, since, p-value is 0.00, and this value is less than the 0.05 level of significance, the null hypothesis was rejected. Hence, there is a statistically significant difference in the interest of students taught biology with ICT Resources based on Score Levels.

Table 2: The Analysis of Covariance (ANCOVA) Computation for the Interest of Low, Medium and High Scoring Students taught Biology with ICT Resources

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	19482.90[a]	16	1217.68	4.03	.00
Intercept	89926.14	1	89926.14	297.39	.00
Scorelevel	6333.52	2	3166.76	10.47	.00**
Preinterest	1262.49	1	1262.49	4.17	.04
Error	104927.54	347	302.39		
Total	5115634.00	364			
Corrected Total	124410.44	363			

R Squared = .316 (Adjusted R Squared = .286), ** mean Significant

Discussion

The research question explored the difference in the effect of ICT resources on secondary school students' interest based on score levels? The hypothesis was that there is no significant difference in interest of low, medium and high scoring students taught biology with ICT Resources.

On Students' interest in biology when taught using ICT Resources based on score levels, there was a statistically significant difference in the interest of students taught biology with ICT Resources based on Score Levels. Therefore, at pretest, the mean scores for Low, Medium and High Scoring students were at clear cut boundaries. But, after the treatment and subsequently at posttest, the group of students that became most interested was the Medium Scorers with Mean interest gain score which was the highest, unlike the high scoring students.

These findings interestingly imply that ICT resources had the most significant effect on students' interest of the medium scorers or average students. However, this result in favour of the medium score level students contradicts the findings of Hong (2014) which concluded that high scoring students were more interested in the academic content, perceiving motivation relevance higher than students in the low scoring level. The research question was what is the difference in the effect of ICT resources on secondary school students achievement based on score levels? We hypothesized that there was no significant difference in achievement of low, medium and high scoring students taught biology with ICT Resources.

Our findings from this study on the effect of ICT Resources on senior school students in biology based on score levels revealed that the mean scores for low, medium and high scoring students were at clear cut boundaries initially. However, after the treatment and subsequently at posttest, the effect of ICT Resources to improve achievement was more evident on the group of students that were medium Scorers with the highest Mean gain score which was the highest, and students of the high Score Level did not gain much from the treatment.

Moreover, there is a statistically significant difference in the achievement of students taught biology with ICT Resources based on Score Levels, in favour of the Medium scoring level. This implies that ICT resources had the most significant effect on students' achievement of the medium scorers or average

students. This finding however is consistent with the findings of Aremu and Sangodoyin (2010), Chan, et al (2020) that concluded from a research on the influence of computer animation on students' achievement, and stating that High and medium scorers performed better that low scorers in all of the scales when he sought to differentiate between low, medium and high scorer in learning and study strategy scales. Chan, Lyons, Kon, Stine, Manley, Crossley, (2020) concluded from an on-screen multimedia perspective that multimedia instruction guide learners' attention and prevent cognitive overload.

Also, Aremu and Sangodoyin (2010) concluded that students of the Low score level did not benefit much from the Technological treatment which is agreement with the finding of this study.

CONCLUSION

The motivational effect of hypermedia software (ICT) on high, medium and low achieving students' interest and achievement explored in this study seem very innovative, and the findings depicting the importance of regulated use of Hypermedia software to engaging and sustaining the interest of medium scorers in biology. The need to study electronic factors that influences or improves students' interest in learning is highly imperative. Given the modern age computer literacy, widely spread distraction and the powerful influence of ICT on the mind of learners. This study has revealed that self-regulated hypermedia use has the potential to motivate, engage, and also improve sustain the interest of medium scoring students. The medium scoring students under normal distribution, have the largest population. This implies that majority of students can be supported by ICT interventions in teaching students. The views of the authors are represented in this paper.

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REFERENCES

Aremu, A., &Sangodoyin, A.(2010) Computer animation and the academic achievement of nigerian senior secondary school students in biology. *Journal of the Research Center for Educational Technology (RCET), 6, (2), 148-161*

Awodun, A.O., Adekunle, R. F., & Femi-Adeoye, K. O. (2019). Students attitude and interest as correlates of students academic performance in biology in senior secondary school. *International Journal for Innovation Education and Research, 4(3),1-6.*

Chan, K. Y. Lyons, C. Kon, L. L., Stine, K. Manley, M. Crossley, A. (2020). Effect of on-screen text on multimedia learning with native and foreign-accented narration. *Learning and Instruction,* 67(10) https://doi.org/10.1016/j.learninstruc.2020.101305

Dignath, C., &Büttner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacognition and Learning, 3(3), 231–264.*

Ekon, E., & Edem, N. B. (2015). Effects of computer-based constructivist instruction on students' achievement and interest in biology. *Educational Research 6 (4), 085-090.* doi:10.14303/er.2013.044

Hong, Z-R. (2014). Effects of a Collaborative science intervention on high achieving students' learning anxiety and attitudes toward science. *International Journal of Science Education, 32 (15), 1971-1988,* DOI: 10.1080/09500690903229304

Lawson, A.E., & Gibbs, A.(1992). The nature of scientific thinking as reflected by the work of biologists and by biology textbooks. *The American Biology Teacher, 54 (3), 137–152.*

Müller, N. M & Seufert, T. (2018) Effects of self-regulation prompts in hypermedia learning on learning performance and self-efficacy .*Learning and Instruction 58 (2) 1–11* https://doi.org/10.1016/j.learninstruc.2018.04.011

Panadero, E., Jonsson, A., &Botella, J. (2017). Effects of self-assessment on self-regulated learning and self-efficacy: Four meta-analyses. *Educational Research Review, 22, 74–98.* https://doi.org/10.1016/j.edurev.2017.08.004.

Wu, H., Guo, Y., Yang, Y. Zao, L. & Guo, C. (2021) A Meta-analysis of the Longitudinal Relationship Between Academic Self-Concept and Academic Achievement. *Educ Psychol Rev 33, 1749–1778* . https://doi.org/10.1007/s10648-021-09600-1

Walan, S. and Enochsson, A.-B. (2022) 'Affordances and obstacles when integrating digital tools into science teaching in preschools,' *Research in Science & Technological Education,* pp. 1–20. https://doi.org/10.1080/02635143.2022.2116423.

Mampota,S., Mokhet'sengoane, S.J, Kuurata,L(2023) Connectivism Theory: Exploring its Relevance in Informing Lesotho's integrated curriculum for effective learning in the digital age European *Journal of Education and Pedagogy 4(4), p 6-12 10.24018/ejedu2023*

Nworgu, B. G. (2006). Educational research: basic issues and methodology. Nsukka: University Trust Publishers.

Oniyide M. K., Kolawole A. O., & Dada E. G. (2023). Performance comparison of computer-based test and paper-pencil test using support vector machine. Fudma journal of sciences, 3(4),478-487.Retrieved from https://fjs.fudutsinma.edu.ng/index.php/fjs/article/view/1674

Olaore, I. B. (2014). The Impacts (Positive and Negative) of ICT on Education in Nigeria. *Developing Countries Studies 4 (23), 154-156.*

Siemen, G (2004) Connectivism: Alerning Theory for the Digital Age retrieved from http://elearnspace.org/articles/connectivism.htm